Unpacking Place Values

Rounding Numbers

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Introduction

How Many Miles to go: Traveling on the Reservation

One day, after trying to teach the students how to round off using vertical number line, I became frustrated. I didn't understand why the students couldn't grasp the idea of rounding off, especially since I have heard the third-grade teacher teach the same concept the previous year. Instead of rounding off to the nearest thousands, ten-thousands, or nearest hundred-thousands, they wanted to write the whole number, all the way to the ones place. Why did they not retain what they learned? Why couldn't they understand? Did they not have enough practice? Furthermore, manipulating numbers even single digit numbers is a foreign concept to learn for the students. Why is it hard for students to learn how to manipulate numbers, especially using a tool like place values chart? In addition, the students were just as frustrated as I was with relearning things they "should already know," but not necessarily taught in a way so that they understand what they are doing. Because of the frustration, most students had pretty much shutdown by the time they reached fourth grade. In addition to reteaching rounding numbers, I also had to motivate the students to learn number sense using place values.

Context and Rationale

Kayenta is tucked in a natural alcove with the majestic Black Mesa to the south of town, the mysterious Skeleton Mesa to the west, and the scenic Kayenta sandstone to the north of town. According to the 2010 Census, the community has a population of 1,589 people. The racial makeup includes: 92.27% Native American, a majority are Navajo, 4.56% White, 0.25% Black or African American, 0.08% Asian, 0.31% other races, and 1.97% Hispanic or Latino.

The community operates under two governments: Kayenta Township and Kayenta Chapter. The Kayenta Township is managed by 5 elected officials whose purpose is to meet the needs of the community. While Kayenta Chapter is part of the greater Navajo Nation Government. The Kayenta Chapter serves people in Kayenta and the surrounding communities both in Arizona and Utah. In addition, there's a single judicial court, a tribal police station, and Indian Health Services that serve the local communities.

Many amenities can be seen at the junction of Highway 160 and Highway 163. Amenities include several fast food restaurants including McDonalds, Sonics, Taco Bell, and Churches to name a few. There are four other casual dining including Blue Coffee Pot, Golden China Bowl, Pizza Edge, and Amigos. In addition, Kayenta has a single grocery store, Bashas Diné Market and Ace's Hardware. Other services in the area include Videos Plus, Navajo Arts and Crafts, and Black Mesa Twin Cinema. There are also three gas stations and convenient stores. There are also three hotels and motels that service mostly visitors to Monument Valley Tribal Park.

The community is served by three schools: Navajo Head Start, Kayenta Boarding School and Kayenta Unified School District. Navajo Head Start is a tribally run school that targets Early Childhood Education for 3-5 years old students. Kayenta Boarding School is a K-8 Bureau of Indian Education school. Kayenta Unified School District is a public school that serves students from Preschool-12 grades divided into three schools, Kayenta Elementary School (KES), Kayenta Middle School (KMS), and Monument Valley High School (MVHS).

Kayenta Unified School District #27 had approximately 1720 students enrolled as of May 2020: MVHS 628; KMS 521; KES 513; and ABC Preschool 57. The student population consists of 94.49% Native American, 1.59% Hispanic, and 0.57% redacted (2018-2019 AZ School Report Card). All the students are on free lunch program. As a whole school district, more than 75% of the students did not meet or exceed when they took the AIMS Science test. In fact, 53% students scored within Fall Far Below range. An additional 29% scored in Approaching range. Only 16% of the students' scores were in the Meet range, which meant that they were able to pass the AIMS Science. Only 2% were able to pass with Exceed range. When the students took AzMerit for ELA, the results were similar; 62% of the student body scored at Minimally Proficient Range, and 21% students scored at Partially Proficient. Minimally Proficient and Partially Proficient is not considered passing. Only 15% of the students who took the ELA portion of AzMerit were able to pass with Proficient range, and only 2% passed with Highly Proficient. The trend continued when the students were assessed using AzMerit for Math. More than 57% of the students scored within minimally proficient; 26% scored at Partially proficient; 15% were able to pass with proficient; and only 3% were able to pass with Highly Proficient.

Kayenta Elementary School is a Title 1 status school. According to the Arizona School Report Card, KES received a grade of "D" for the 2018-2019 School Year. Some of the issues that students face include chronic absenteeism. In one school year, 753 students were reported for chronic absenteeism. In addition, 17 students were reported to Law Enforcement that school year; 4 students with disabilities, and 13 students without disabilities. Furthermore, 36 students received out of school suspension; 5 students with disabilities, and 31 students without disabilities.

In the 2018-2019 school year, there were 106 Fourth Graders. The Fourth-Grade population consisted of 98.11% Native American, and 1.89% were redacted. All Fourth Graders took AIMS Science, AzMerit ELA, and AzMerit Math. AzMerit uses a cut score method to determine if a student is minimally proficient, Partially proficient, Proficient, or Highly Proficient. A cut score range of Proficient and Highly proficient is considered passing. The resulting trend for the assessments taken by the fourth graders mirrors that of the school district results, except for science. Fourth graders seem to fair better in science than all other grade levels that take AIMS Science. Only 28% of the students' scores in Falls Far Below range, 49% scored in Approaching range, 20% passed with a score in Meets range, and 4% passed with exceed range. The students who passed with Meet or Exceed was even in terms of the number of female and male students: 18% females passed with meet, 5% females passed with Exceed, 22% male students passed with meets, and 2% male students passed with Exceed. When Fourth-grade students took AzMerit in 2018-2019 School Year, 57% of the students scored minimally proficient for ELA, 17% scored in Partially proficient range, 24% passed by scoring within Proficient Range, and 2% passed with a score within the Highly Proficient Range. According to AzMerit results for 2018-2019 school year, our fourth graders are struggling with mathematics. A whopping 56% of the students scored within the minimally proficient range. An additional 30% of the students scored within the Partially Proficient range. Only 14% were able to pass with a score of Proficient. None of the students scored with a score of Highly Proficient for Mathematics. Unfortunately, I do not have the breakdown of the math scores by standards.

KES adopted Eureka Math as their Core Math Program for about 4 year now. The first year we implemented Eureka Math, it was a disaster because it required a different routine, a different

way of thinking, different strategies, different approaches to math, numerous student paperwork, and it was scripted. Even teachers had a hard time adapting to Eureka Math. There was so much to cover daily, yet it could not be done. In addition, students were overwhelmed with the vocabulary and the multiple steps needed to get to an answer. It required more input from the students. It frustrated the teachers and the students so much that first year that some of the teachers went back to their comfort zone, back to how they are comfortable in teaching math; some required drills, memorizing steps and procedures to solving a problem. However, were mandated to teach math using Eureka Math. Eventually, everyone was onboard. Again, some teachers still managed to find shortcuts, sometimes not for the better to teach math. To this day, students still struggle with Mathematics, and it shows in our scores.

Typically, my students consisted of self-contained English Learners (EL) in Structured English Immersion classroom. However, the next school year, the EL students will be distributed among all fourth-grade teachers in a general education classroom. This will be the first time I will be one of the six teachers teaching general ed fourth grade students. The challenge in creating a curriculum is that I have not taught general-ed students since 2014. I am not familiar with their strengths and weaknesses in number sense. However, just by conversing with other fourth-grade teachers during grade level meetings, I sense that students have very similar issues that my EL students had. I also understand that some of the students excel at math, which often is not something I have had. I am looking forward to creating a curriculum that both challenges the proficient students, and also motivates the struggling students. In addition to the Arizona Academic Standards, and the Diné Culture Standards, I have to remember to include English Language Proficiency (ELP) Standards for my English Learners. Furthermore, I have to be mindful of the Individual Plans for Exceptional Students, including gifted students.

Most textbooks adopted in schools, including the one adopted by Kayenta Unified School District, seem to have one thing in common. “Speaking very roughly, the focus has been on learning what one might call “shopkeeper arithmetic”: accurate computation (addition and subtraction, multiplication and division) with relatively small numbers, and some estimation, in the form of “rounding.” (Howe, 2018, p.x) Although Eureka claims to provide “multiple daily opportunities to build fluency in mathematics”, it’s still “shopkeeper arithmetic” practice. The teacher teaches a strategy, then the students practice in the classroom and at home with homework practice. In the classroom, I have some control over how much students accomplish with practice. However, homework practice is another matter. Most students often make minimal to no attempt. Some students do learn with minimal practice, but the rest of the students need the practice.

The goal of the unit I want to create involves “instruction in whole number arithmetic that more attentions should be paid to the algebraic structures that enable the wonders worked by the base ten system, and to understanding relatively large numbers in an approximate way” (Howe, 2018, p. x). In order to fulfill the state standards for fourth grade regarding number sense and place values, my unit requires large numbers. In addition, I realized that I cannot just focus on one aspect of Numbers and Operations in Base ten like I originally thought. In order for students to establish proficiency, they need to get comfortable using and changing between different strategies associated with Numbers and Operations in Base Ten (NBT) and Operations and Algebraic Thinking (OA). The first objective is to establish number sense skills, then build on

that to establish base ten understanding, and finally using that understanding to teach them to round off numbers effectively to the nearest 1,000, 10,000, 100,000, and 1,000,000.

To accomplish this goal, I will create a curriculum that would utilize mileages on the Navajo Reservations. Because fourth-grade standards require students to utilize place values up to 1,000,000's place, using the mileages would not fulfill the standards. However, using mileages on the reservation would be a good review for third grade standards at the beginning of the school year. It would be ideal to start off with something they are familiar with and have general knowledge. After a couple of weeks of review, we can use the same concept of using mileages, but expand it to include the whole United States of America. It may expand to mileages traveling round-trip or multiple trips by plane to other countries. However, the trips around the world do not yield the miles need to fulfill the 4th grade math standards, which requires students to work with numbers between 1,000 and 1,000,000. In addition to mileages, students will use the expansion of the reservation in square miles from the time of the signing of the Treaty of 1868 and the current size.

Content Objectives

The purpose of this unit is to help students develop understanding and mastery of estimation and approximation of numbers between 1000 and 1,000,000 using content relevant methods such as using place values chart, number line, and expanded notation. It is important that the students understand that the tools presented to them will help them construct meaning for themselves. Many students who arrive at fourth grade had not had enough exposure with place values in based ten even though they have been using it since Kindergarten. Just like our new principal, Dr. Carmen Moffett, said during curriculum development on Saturday, we cannot focus on the "icing" on the cake, but develop lessons that unpack standards, create highly rigorous lessons that engage students so can become proficient learners. This Unit is to help develop in depth understanding of base 10 numbers for my fourth graders so they can estimate and approximate numbers effectively. One of the first steps of reaching my goal is make sure that the students have an accurate understanding that the strategies I am going to use in conjunction with estimation, rounding, and approximation have purpose and structure.

History of the Navajo Reservation

The Navajo Reservation is one the largest Native American Reservations in the United States. It stretches across 3 states: Northwestern New Mexico, Southeastern Utah, and Northeastern Arizona (where a majority of the reservation lies). The reservation was established in conjunction with the signing of the Treaty of 1968, an agreement between the Navajo leaders and the federal government. The Treaty allowed the Navajos to return to their old country. However, the reservation was "only a small portion of the land they had once inhabited" (Denetdale, 2008, p. 92). Between 1887-1928, Native Americans lived through a period called the Allotment and Assimilation period which was headed by religious group to solve the "Indian Problem." The General Allotment Act also known as the Dawes Act passed in 1887. Although the government believed it was a more "humanitarian approach" to the Indian problem, the provision of the act decreased the land base of many reservations of many tribes. The Act itself demonstrated the belief that tribal members should learn how to farm so they allotted land to male members of the tribe. However, tribal lands were unsuitable for farming. In addition, Indian Agents refused to

ration or issue annuities to tribal members who refused to farm. Many tribal allotment holders sold off their land, which dramatically decreased reservation from 138 million acres to 48 million acres by 1887 (Wilkins,1987).

Fortunately, the Navajos were excluded from the provisions of the General Allotment Act. By 1890, the original Navajo Reservation became inadequate because the population of the Navajos increased and the number of live-stock also increased. "The original reservation of four million acres was inadequate, so from 1876 to 1901, federal executive orders added land to the original treaty reservation that tripled its original size" (Denetdale 2007, p. 146). There were two reasons that the Navajos were able to increase their land base. First, they had honest Bureau of Indian Affair Agents who recognized and persuaded the federal government that the reservation was not suited for farming. Second, the Navajo leaders effectively lobbied on their tribe's behalf to increase the size to accommodate the population increase, and the need for more pasture for their livestock (Wilkins, 1987). Although the Navajos rejected the Indian Reorganization Act, 234,000 acres were added to the reservation through a congressional legislation.

"The provisions for the signing of the Treaty of 1868 included "stipulations about land base, American Education for children, instruction in Christianity, and annuity for 10 years" (Denetdale, 2008, p. 92). One important stipulation allowed the establishment of trading post on the reservations. The trading posts served as the main hub for trading goods for textile or livestock. Furthermore, most of our current communities were established around former trading post.

What is Number Sense

What is number sense? Defining number sense is complex because it is rooted in many strands of math, and open to interpretation. When we think of students with strong number senses, most likely we are thinking about the student who "probably understands numbers, ways to represent numbers, relationships among numbers, and number system" (Shumway 2018, p. 11). In addition, students are able to make reasonable estimation, complete fluent computations, and use strategies effectively. Furthermore, the student uses reasoning strategies, and uses visual models. Students who have strong number sense are often "comfortable and confident with numbers, know how they are used, know how to interpret them, and know when they make sense. People who have number sense have a good understanding of meaning of number. They are able to "use numbers and understand how numbers are used in the world around them" (Turkel, 1988, p. 53). Often people with good number sense choose an appropriate method of processing numbers when they approximate numbers, computations, and mental estimation. Strong number sense is also including the ability of a student decompose and recompose a number and understanding of number properties.

It is important to develop fundamental number sense in the early years. Too often students associate numbers to worksheets and computations (Turkel, 1988). Number sense is a gradual and evolutionary process. Awareness of how numbers are used need to be observed and developed by students in the fundamental stages of number sense. Children often exhibit creative and sometimes effective strategies. As the students develop better number senses, the number of strategies a student uses diminishes because students start relying on standard algorithm. Executing standard algorithm is often the easiest strategy to uses without really

"thinking" about it. There is a need to provide rich situational activities that promote problem solving abilities and stimulate different components of number sense.

Often students who come to fourth grade do not have any kind of number sense for various reasons, and end up not doing well mathematics. Before students are able to tackle fourth grade mathematics, they first need to establish number sense. One way is to establish a number sense routine that links visual and symbolic understandings of quantities. "Subitizing and spatial structuring are important to our students' ability to see and conceptualize quantities" (Shumway, 2018, p. 33). Subitizing is the ability to determine an amount without counting. There are two types of subitizing: perceptual and conceptual. Perceptual is the ability to recognize a small about, often less than five, without any mathematical knowledge. Conceptual subitizing is the ability to recognize patterns and creating units. Students need to count and establish patterning abilities to develop number sense. For example, a person may recognize that a die which has 5 dots, are arranged a certain way; two dots on top, one centered in the middle, and two on the bottom. If you recognize the five on a die, then you can quickly skip count by five mentally to determine an amount on multiple dice.

Rounding Numbers

According to the Arizona Math Standards for fourth grade, the students are expected to use place value understanding to round multi-digit whole numbers to any place. Students need to understand that sometimes math is not exact. Sometimes a "rough estimation" is needed to size up a situation, and decide if the estimation is reasonable. In fourth grade Eureka math in math, students are expected to round numbers to the nearest thousand's place, ten-thousand's place, and a hundred thousand's place. However, the lessons are presented in a limited timely matter. Most students do not get the opportunity to practice reasonable estimations. Both estimation and rounding are used to find approximation or "ballpark figure" rather than a precise figure. Estimation is an approximation that is used to find a broader figure. Estimation is a rough guess or calculation based on prior knowledge and given information. A person might use a small sampling to determine a quantity onto a larger sample. For example, a person might estimate the number of potatoes in a bag by counting the visible potatoes. Depending on the size of the potatoes and the size of the bag a person may estimate how many potatoes are in the bag, despite the variation in the bag. Rounding on the other hand is working from a given number. The given number is usually rounded to the original value by scaling up or down, depending on a given number in a place value part that is right of the place value we want to round to. For example, we 4,535 will round off to 5,000 if we are rounding the nearest thousand because the number right of the thousands place is 500. That number scales down from 5,435 to 5,000.

In a place value system, each place value part increases by a magnitude of 10 times the previous smaller magnitude or smaller place value part. Each place value unit is only allowed up to a digit of 9. There are two procedures for rounding: rounding up and rounding down. The digit 5 in any multiple of 10 determines whether you round up or round down. For example, if you have a number like 254, there are two ways to round this number. If your round 254 to the nearest tens place, the two choices are 250 and 260. To determine whether to round up or down, you have to look back at the ones place and determine if the digit in the ones place is less than five or equal to and greater than 5. In this case, the number 4 in the ones place is less than 5 so you would round down to 250. If you were asked to round to the nearest hundred, then you

would look at the digit in the tens place to determine if you round up or round down. IN this case, the digit in the tens place is 5, so you would round up to 300. In addition to rounding single multi-digit numbers, students will also use rounding to compare two base ten numbers. Not only that, it can be used to determine reasonableness of an estimation by comparing the same number rounded to different units of a place value system.

The accuracy of the rounding is often explored as reasonableness of rounding at a younger grade level. Very few students are able to analyze the reasonableness of rounding. The precision of the effects of rounding depends on the number of place value parts were used. There is a higher percentage error if students only use one digit in the highest place value part. Using "the largest place value part of a number always contains at least half the value of the number, and at least 90% about half the time" (Howe, 2018). The percent error decreases as students two digits to round off a number. "The largest two place value parts of a number always contain at least 90% of the number and at least 99% of the number half the time" (Howe, 2018). The accuracy of rounding increases tremendously if you use the three largest place value digits to round off a number. "The largest three place value parts of a number always contain at least 99% of the number, and 99.9% about half the time" (Howe, 2018).

Place Values

Writing numbers using base ten place values system helps us understand large numbers easier. Place values parts is base ten numbers in the sum of parts. When we start counting, we start off with one digit: 1, 2, 3, 4, 5, 6, 7, 8, 9. When we reach 9, the next number is ten. When we write ten, it becomes a two-digit number, but each digit represents a different base ten value: 1 ten and zero ones. The base ten notation is basically an exchange of 10 ones for 1 ten, which is the first base ten unit. When we continue to count to 11, it interprets as 1 yen and 1 one, and 12 which represents 1 ten and 2 ones, up to 19. If you add one more one, we acquire a second bundle of ten, so we write it as 20, which basically means 2 ten and zero ones. We continue to count one at a time, and each time we acquire 10 ones in the ones place, we exchange it for one ten until we count to 99. When we add 1 one, we collect 10 ones, so we exchange it for one ten. The one ten in addition to the 9 tens makes 10 tens, so we move it to the next base ten unit which is hundreds place. One hundred is 10 tens or 10 x10. Then we start all over (Howe, 2020).

When elementary teachers and students hear place value, we commonly think of a place values chart where a number line 325 is expressed as 3 is in the hundreds place, 2 in the tens place, and 5 in the ones place. When we talk about place values, we express the number can be represented as a sum of its place value parts which are represented by base ten units. To help us understand more of the place value, let's explore the Five Stages of Place Values. In the first stage, a number is identified as standard form. A number in standard form is understood and implied as the sum of its place value parts. For example, 325 = 300 + 20 + 5. The implications are that 325 is the same as 3 hundred, 2 tens, and 5 ones which leads to the second stage is the expanded form. Each place value part is 10 times larger for each part as it moves from smaller place to the next place value part going from right to left on a place values chart. In other words, in expanded form notations, you are showing the numbers in place value parts. In the next stage of Stages of Place Values shows the notations in base ten units. For example, 300 = 3 x 100, 2 X 10, and 5 X 1. The 1, 10, and 100 are base ten units on a place value. The 3 represents the number of hundreds, the 2 shows how many tens we have, and the 5 shows how many ones we

have in the number 325 (Howe, 2019). The confusion for fourth graders comes in when the students are introduced to the third Stage of Place Values because the base 10 units are used rather than the standard notations. The Fourth stage is becoming more complicated because they now have to decompose the base ten units into multiples of 10. In stage four, base ten units are decomposed further in multiplicative relationships to each other. The unit ten in 2 x 10 actually consists of one ten, and the unit hundred in 3 X 100 is actually consists of ten tens or 10 x 10. If there is a thousand unit, then the 1,000 consists of ten hundred which is 1,000 = 10 X 100, and so on you go up larger place values chart. In the final stage, we begin to see a pattern where each larger unit can be decomposed further into multiples of 10. Back to 1,000 = 10 X 100. The unit 100 can be decomposed to 10 x 10, 1,000 consists of 1,000 = 10 x 10 x 10. It can be written as $1,000 = 10^3$ known as the power of ten. Basically, it is the number factors of tens used to make the product. The power of 10 not only defines how large a given unit is but also defines how different units are different sizes. In other words, a unit may be 10 times as large as the next smaller unit, but it is only $1/10^{th}$ as large as the next larger unit (Howe, 2019).

Although students are introduced to stage 4 of the Five Stages of place values, for my unit I will focus on using expanded for to help students round off numbers. The students will decompose a standard number to the sum of its parts or into expanded notations (Howe, 2018). Say that I have 235 in standard form. Then I will ask the students to round off to the nearest say 100. Before the students decompose the numbers, I will ask the students to identify the two units of hundreds 235 falls between. In this case, the two units of hundreds are 200 and 300. Then I will ask the students to decompose the standard number into expanded notation: 235 = 200 + 30 + 5. Once, they break the number into the sum of its place value parts, I ask them to look at the next smaller unit, which is 30, and determine if it is closer to 200 or 300. Since 20 is less than 50, the midpoint, then the students will round down to 200.

Number Line and base ten numbers

Representing numbers can be displayed in many ways including using a number line. A number line is a visual representation of the order of numbers, which stretches infinitely both ways. There are two types of number lines. Typically, number lines are represented with a horizontal line. There is instance where number lines can be presented as vertical lines. An instance of using a vertical number line would be when we measure temperatures on a thermometer. Often, a place is chosen to represent 0 as a starting point, which is referred to as the "origin". Customarily, another place to the right is chosen to represent 1. The distance between 0 and 1 is referred to as a unit. The unit provides the scale to locate other numbers on the number line. We can easily complete a number line once you choose the location of the origin and the size of the unit. Our number line may be confined to a portion of the line depending on the limited time and size of a paper. The arrow on each end of the line shows the infinite continuation of the line.

Typically, number lines of a base ten is one sided with the origin beginning on the far left and ends at 10 on the far right for single digits or unit of ones. If the numbers are larger, whether its double digit or more will not fit on the single unit scale. For example, if you want to place 8,342 on a number line, the scale of the number of the number line has to be larger but the unit length will be smaller. The smallest based ten unit that is larger than 8,342 is 10,000. So, we have to create a number line with the origin or 0 will be on the far left, and the unit size on the number line will be by thousands: 1 thousand, 2 thousand, 3 thousand, until we reach 10 thousand. So

where will the number 8,342 fall on the based ten number line? It is greater than 8,000 but less than 9,000. To place 8,342 more accurately, we subdivide the intervals between 8,000 and 9,000 by separating into 8,100, 8,200, and 8,300. Since our number is more than 8,300, but less than 8,400, it will lie between these two numbers.

To pinpoint our number more accurately, we need to continue with the subdivision into ten equal subdivision to represent 10's place. However, as it is, our number line is very compacted and would be hard to see, so we will not be able to draw them. To make the intervals more visible, we kind of have to "blow it up" or increase the unit size between 8,000 and 9,000. Then increase the interval size and unit size between 8,300 and 8,400 to see the smaller units. We can blow up again to intervals of the unit size by tens between 8,340 and 8,350. Eventually, keep blowing it up until the intervals between the unit sizes is by ones. When you are finding the location of a base ten number accurately on a number line, you start from the largest place value, locate the interval, and then subdivide further into 10 pieces. Continue subdividing into intervals of ten for each successive place value until you get to the last place value piece.

When I introduce number lines, students always have a hard time plotting numbers on a number line. For some students, they catch on quickly, especially if they have very good number sense. However, students who are struggling will benefit from spending a significant amount of time "blowing up" number lines to get them comfortable with plotting points in a number line so I can use number lines to teach them how to round off.

When the student plots the number line, the students will determine the endpoints and the midpoint. The endpoints chosen depends on what place value part you want to round off to. The midpoint is often the digit 5 with any ten-base unit for any given place value part. For example, if I round off 347 to the nearest place hundreds place, the students will first determine the endpoints in units of 100s. in this case, the number falls between 300 and 400. The midpoint becomes 350. Then the students plot the point. They can use lines to break down the line into smaller units to represent the tens. Once they plot the number on the number line, I will ask them if 347 is less than 350 or more than 350. Most of the time, if the number is less than the midpoint, then we round down to 300. The number line maybe horizontal or vertical. Eureka math, our core program teaches the students rounding using vertical number lines.

Distance Learning due to Covid-19

The beginning of this school year is not like any other school year since I started teaching in 2001. The Covid-19 Corona Virus has changed classroom instructions for our school. In these unprecedented times, most schools have opted for online learning, including Kayenta Unified School District #27. Strategies for math need to be modified to meet the needs of the students. First of all, in Kayenta, we need to consider who has internet access, and determine if the student's internet access is reliable, especially in homes where there are multiple children who need go online for instruction. What do we do with students who do not have internet services or does not have the capabilities to get to a school provided hotspot?

First of all, students who do not have internet access need to be addressed. Every student at fourth grade will be given a Chromebook regardless of whether they have internet access or not. Learning Packets will also be prepared for each student. The learning packets will contain

materials and resources students will need for the following week. Furthermore, all students will receive jump-drives. The purpose of the jump drives is to send and receive documents. In addition, recorded lessons will be sent home using the jump drive for students who do not have internet access or cannot make it to a hotspot. The 9% of the student body who do not have electricity will also be issued solar packs to recharge their Chromebooks. Students without internet access will have an opportunity to access through one of the 13 free hotspots provided by the school. Unfortunately, due to social distancing guidelines, the students will be having to stay in their vehicles. It will be challenging to stay in your vehicle all day, especially for families with multiple learners. so, hotspots will mainly be set up to download or upload assignments and to communicate with the teachers. The motto of our Principal is "Practice Flexibility, be adaptable, be understanding, and be caring."

Teaching Strategies

The emphasis on teaching in this unit is to help students understand that when you round a number, you are changing it to a number that is easy to work with, but still close enough to use. A rounded number often has one or more "round" zeros at the end. Rounded numbers give a rough idea of an amount. When an estimated number is used, you will see words such as *about, close to, just about, a little more than, approximately, or almost.*

Vertical Number Line

In a vertical number line, there are 3 point; lower endpoint, midpoint, and higher endpoint. Determining the points on the number line depends on which place value you are asked to round off to. For example, if you are asked to round 32,453 to the nearest thousands, your lower end point will be 32,000 because it is the closest one thousand less than 32,453. The upper end point will be 33,000 because it is the closest one thousand greater than 32,453. The midpoint will be 32,500 because it is halfway between 32,000 and 33,000. When you plot 32,453, the number is less than the midpoint, therefore; you round down to 32,000. A horizontal number line can be used the same way.

Place Value Chart

You can use place value chart to round a number. Before the students begin, have them draw a place value chart. Have the students write the numbers in the chart. For example, if you are asked to round 42,613 to the nearest thousand, the first step would be to find the thousands place. Students may circle or highlight the intended place value that needs to be rounded. In this example the thousands place is 2 thousand. Then you look at the digit one place value to the right, which happens to be the digit six or 600. Need to underline the digit that represents the hundreds place. If this digit is 5 or greater, round up to 43,000. If the digit is less than 5, round down to 42,000. When you round down, the digit in the rounding place stays the same. In addition, you can round to any place value you can round to ten-thousands (40,000), round to the nearest hundreds (42,700), or to the nearest tens (42,610). Ask the student to circle the place value that they are asked to round off to, and identify the digit to the right if they are having problems. Students may use mnemonics or chants to help them remember how to round. For example, "four or less, let it rest (stays the same)," and "five or more raise the score (add 1 more)."

Expanded Notation

Another strategy that students may use is to decompose a given number into expanded form. Then identify the number that the students need to round to. For example, if a student is asked to round 184,325 to the nearest ten-thousand, the first step is to decompose the number into expanded notations which becomes 100,000 + 80,000 + 4,000 + 300 + 20 +5. From the decomposed number, I can see that in the ten-thousand place is 80,000, so I can determine that the whole number falls between 80,000 and 90,000. Then I look at the one hundred thousand, I can see that there is 4,000, and according to the rules, it is less than 5,000, so I round down to 180,000.

Recorded Presentation in Google Classroom for Asynchronous Learning

For students who do not have internet access or limited internet access, the teacher will send home recorded lesson plans using jump drives. Since I chose to use Google Classroom, I will record my lesson using google classroom. All pertinent assignments and resources will also be included on the jump drive, along with hard copies. Ideally, the parents and students will pick up their assignments on Mondays. Completed assignments will be dropped off at the school in a drop off box.

Even though students are not at school, they are still expected to work on their subjects at designated times according to the school's Master Schedule. During the designated time, the students will view the recorded lesson plan, and do any activities that go with that lesson. One of the benefits of recorded lesson plans is the ability of the child to play back any lessons.

Cooperative Learning in Break-Out Rooms during Synchronous Learning

With this unit, I intend to use break out rooms with smaller homogenized learning groups. In order for breakout rooms to work efficiently, I need to first establish guidelines and routines. Each child will have a job in the breakout room. Students need to learn how to work together, so they will be taught to work as a team. Teamwork is key to success. One tried and true method is to assign a leader, a recorder, and a reporter. IF all students have expectations, they will be more inclined to stay on task. Roles of each student will change, so it gives everyone an opportunity to be a leader, a recorder, and a reporter. The purpose is so that the same person is not always answering the questions.

No matter how many times you explain an assignment, there are always times when most students do not know what to do. I will visit each breakout room and make sure everyone is on task, and also make sure everyone knows what they are doing.

An air of respect needs to be established. Another benefit for doing smaller groups is that it allows children to be heard. I understand how hard it for some students to speak up because they are not confident with speaking up. In order for that to happen I need to send a clear message that everyone thinks differently and math problems can be solved many different ways.

Classroom Activities

This unit starts by showing the students a map of the reservation, and explaining to the students that the Navajo Reservation was not always the size it is right now. Originally, the reservation was quite small. In fact, the original size of the reservation is shown as a brown rectangle on the Navajo Nation flag. Through Executive Orders, the reservation expanded throughout the years.

Virtual Field Trip

Using google map, take the students on a virtual trip throughout the reservations. In this activity, the students will review rounding to the nearest ten and hundred (third grade standard). Tell students that they will take a virtual trip to a town on the reservation. Use a google map and give them the exact miles to that town from Kayenta. Then ask them to round the number to the nearest ten in miles or nearest hundred in miles. This activity also serves as a lesson that rounding can be applied to real life.

Recreate the Reservation

In this activity, students will be given pieces of the reservation. The only information on the pieces would be the year it was added. The students will be given information of the land that was acquired through each executive order. The student will round off the size of the land that was added to the reservation to the nearest thousand, nearest one thousand, ten-thousand, hundred thousand, and one million using acres and square miles as a unit of measurement. Then, the students will be given the reservation in square miles. The students will also be shown the current size and shape of the current reservation. The students will arrange the pieces together to look like the current reservation. Show them a Navajo Nation flag and remind them that the brown rectangle on the reservation is the original size of the reservation.

Visual Routines

Establishing number sense is key for students to become knowledgeable mathematicians. I want to create quick daily math routines that encourages students to use, enhance, and build on their subitizing abilities" (Shumway, 2018, p.35). Quick images are pictures that show quantities that are organized a way so they are able to organize and combine groups. In addition, it encourages students to decompose quantities. Because I will be working on estimating miles from town to town, my quick images will be related to measuring distances. For example, I could use unit squares as a measuring tool between two towns I want the students to measure. The unit squares could be colored in multiples of 3- or 5-unit square. I might also use unfix cubes. I will show the image and the students try to describe or name the measurement of an object. These could relate to estimations because certain objects do not fit perfectly between two towns on a map.

Wick Sticks

The students will use wiki sticks to help them estimate and round off distances between two towns on the Navajo Reservation map. As part of their packet, students will be given a printout of a map and wiki sticks. Students will first cut up the wick-sticks to the size of the distance legend on a map. Then they will stick as many wiki sticks as they can between two given towns. The students will use the legend distance to estimate the distance of the two towns in miles.

Student Assessment Plan

Pre-Assessment

Students will be given a pre-assessment to determine what mathematical skills they possess in terms of number sense and rounding. Does the student understand quantities? Does the student have the ability to compose and decompose numbers? Does the student have the ability to give numbers meaning or find the relationships of numbers?

Word Problems

Students will be asked to round off numbers related to Navajo reservations like the population of the reservation since the 2010 Census. According to the 2010 Census, the population of the Navajos in the United States is 173,667. In addition, students will round off the number of head sheep on the reservation before the enactment of the Navajo Livestock Reduction of 1930. Have students work on the word problems. When they are finish, determine what they did well, what kind of strategy they need to use, and what they need to get to the next level.

For example, according to the 2010 Census, there are 173,667 Navajo people. Round this number to the nearest hundred thousand to estimate how many Navajos were counted for the 2010 Census. Use pictures, numbers, or words to show your work.

A word problem could be made more challenging. For example, a newspaper article estimated that there were 2,000,000 sheep on the Navajo Reservation in 1931. If the newspaper article rounded to the nearest million, what is the largest number and smallest number of sheep that could've been on the reservation at the time?

The mathematical idea in this problem is to determine the student's ability to use a place value chart, a number line, or other strategies used to round off. In addition, student's assessment will determine what they know or able to do. Finally, the assessment will decide the next step for the student in terms of mathematic.

Rounding to Different Place Values

In addition, students will revisit the estimation of the expansion of the reservation. For the assessment, students will round to the nearest thousand, ten-thousands, and/ or hundred thousand, then determine which would be a better way to round off. This is going to be especially key for two additions of the reservations that are close in size, rounding would either determine if they round to the same number. Can a child reason why two numbers might round off to the same number, and how it rounding can be differentiated so it can be more accurate?

Alignment with Standards

This unit will align with the following standards:

AZ Math Standard 4.nbt.a.3 Number and Operations in Base Ten

Students will use place value understanding to round multi-digit whole numbers to any place using virtual trips around the reservation and around the world. In addition, they will use

rounding to establish the size of the reservation in acres as it expanded in size through executive orders.

Diné Culture Standards – I will develop an understanding of Dine Way of Life. Concept 2 – I will apply and practice the Dine way of life through planning. PO 1 - I will retell my cultural teaching of Earth and sky.

Students will use their knowledge of the reservation (Earth) to round off numbers in terms of miles in virtual field trip and expansion of the reservation.

Resources

AZ School Report Cards: District Information. (n.d.). Retrieved from https://azreportcards.azed.gov/districts/detail/4396

The Arizona Department of Education site gives information about the demographics and other details related to Kayenta Unified School District.

AZ School Report Cards: School Information. (n.d.). Retrieved from https://azreportcards.azed.gov/schools/detail/5642

This site links you to the Arizona Department of Education's AZ School Report Card for Kayenta Elementary School.

Denetdale, J. (2007). *Reclaiming Diné history: The legacies of Navajo Chief Manuelito and Juanita*. Tucson: University of Arizona Press.

Jennifer Nez Denetdale, a Navajo Historian, explores and examines Dine History from a Navajo point of view. This is a great resource to provide a contrast in the perspective of how Navajo history is told.

Denetdale, J. (2008). *The Long Walk: The forced Navajo exile*. New York: Chelsea House.

In this book, Jennifer Denetdale writes about the effects of broken treaties and the Long Walk.

Eureka Math. (2015). Washington, DC: Great Minds.

Goodman, J. M., & Goodman, M. E. (1989). *The Navajo atlas: Environments, resources, people and history of the Diné Bikeyah*. Norman, Okla.: University of Oklahoma Press.

This is a great resource for teachers and students. It contains information on natural resources, as well as economic resources, and demographics of the Navajo reservation.

Gross, K. I. (2007). *Intel Math: Math Reference Manual Readings, A K-8 Mathematical Professional Development* (Version 2.5). Vt.: Intel Corporation.

Howe R. (2020). Approximating Numbers by Rounding. Unpublished manuscript, emailed 06/08/2020.

Howe R. (2018). Big Numbers, Small Numbers. Unpublished manuscript, emailed 06/08/2020.

Howe R. (2020). Basics of the Place Value System. Unpublished manuscript, emailed 06/08/2020.

Howe R. (2020). Comparing Base Ten Numbers. Unpublished manuscript, emailed 06/08/2020.

Howe, R. (2019). Learning and using our base ten place value number system: Theoretical perspectives and twenty-first century uses. *ZDM: The International Journal on Mathematics Education, 51*(1), 57-68.

Howe R. (2020). The Size of Base Ten Numbers. Unpublished manuscript, emailed 06/08/2020.

Howe R. (2020). The Size of Base Ten Numbers and the Number Line. Unpublished manuscript, emailed 06/08/2020.

Gross, K. I. (2009). *Intel Math: Teacher Manual Units 1-4, A K-8 Mathematical Professional Development Program* (Version 2.5). Vt.: Intel Corporation.

McPherson, R. S. (2001). *The Northern Navajo Frontier 1860-1900*. Utah State University, University Libraries.

Robert S. McPherson writes about how the Navajos were able to expand their reservation. This book is especially helpful when researching how the reservation expanded and why it expanded.

NOTICE OF PUBLIC MEETING OF THE GOVERNING BOARD OF KAYENTA UNIFIED SCHOOL DISTRICT NO. 27 Agenda. (2020, May 13). Retrieved from https://tb2cdn.schoolwebmasters.com/accnt_189928/site_191946/Documents/May-13-2020-Agenda.pdf

The Board Minutes provided student enrollment for Kayenta Unified School District and Kayenta Elementary School.

Shumway, J. F. (2011). *Number sense routines: Building numerical literacy every day in grades K-3*. Portland, Me.: Stenhouse.

Shumway, J. F. (2018). *Number sense routines: Building mathematical understanding every day in grades 3-5*.

Jessica Shumway explores the importance of number sense, and the importance of establishing a number sense routine to build and solidify number sense foundation that will benefit all

students. This is a great resource for teachers in terms of how to implement number sense routines to help establish number sense in the classroom.

Zolbrod, P. G. (1999). *Diné bahane: The Navajo creation story*. Albuquerque: University of New Mexico Press.

Wilkins, David E (1987). *Diné bibeehaz'áanii: a Handbook of Navajo Government*. Navajo Community College Press.